is observed to blow at the rate of 72 miles per hour, there will be moments during the passage of the mile in question in which the velocity will probably be as high as 96 miles per hour and at other moments as low as 48 miles per hour. (See Professor Marvin's Bulletin on Anemometry, Circular D, Instrument Division).

15. The highest velocity ever recorded at Block Island is 84 miles per hour. At Hatteras, in 1899, 105 miles, and at Galveston, in 1900, 84 miles per hour were recorded before the instruments were blown down, but it is estimated that at Galveston the wind attained a velocity of at least 120 miles per hour.

The highest velocity actually recorded on self-registers in the United States, except at Mount Washington and Pikes Peak, is 138 miles per hour at Cape Lookout, N. C., August 18, 1879, just before the anemometer was blown away. The estimated velocity after the anemometer was blown down was 165 miles per hour. At Mount Washington 186 miles was observed with a heavier anemometer than we now use, and needing a large correction.

Our anemometers do not generally withstand the terrific force of West Indian hurricanes or of the true tornadoes, but this is not wholly due to the great horizontal speed of the wind; it is largely owing to such other matters as the following: (1) The rapid rotation sets up strains within the anemometer that tear it to pieces; (2) the horizontal wind alternates with violent up or down gusts that cause the revolving arms to lift the spindle up out of its socket; (3) the inertia and pressure of the wind against the hemispheres is often doubled by the impact of the raindrops carried along with the wind; (4) the cup and arms become clogged with snow or frost formations, and thus offer a much greater resistance than the instrument was intended to bear; (5) the debris of buildings and trees carried along by hurricane winds tear the anemometer from its supports.

16. Observations do not generally show that thunderstorms follow valleys. We would hardly expect them to do so when we remember that the base of a thunderstorm cloud is about half a mile above the surface and its summit from 2 to 6 miles above. The thunderstorm cloud may start in a valley, but soon outgrows the influence of small local features. The study of thunderstorms requires a thick network of stations and large topographic maps. It would be well if such study could be carried out in greater detail for specific small areas of 10 or 20 miles in diameter.

17. Grafton, N. H., has an elevation of over 300 feet, which is considerably above the valleys of the Merrimac and the Connecticut rivers, between which it lies. Its altitude is, therefore, conducive to frosts, since the rate of radiation of heat from the earth at night increases with the elevation. Hills and mountains are not so liable to frosts as lowlands at their immediate foot, since the cold air gravitates down the sides of the former to the valleys below, thus causing early frosts in the valleys. Does not the Grafton station receive such cold air drainage from neighboring higher land? There must be many similar frosty spots in New Hampshire and Vermont, not provided with voluntary observers, therefore we doubt whether Grafton really is a "great frost center."

19. The average rainfall diminishes rapidly as we go west from the Mississippi, but so-called cloudbursts occur in all sections alike, the most intense being among the mountains of the far west. The Gulf coast is liable to excessive rainfalls, and so are all the States east of the Rocks Mountains, but principally during thunderstorms or hurricanes. For a full discussion of this subject, see Weather Bureau Bulletin D, p. 52.

For a more complete discussion of these various subjects, the reader is referred to the special publications of the Weather Bureau, a list of which is given in the MONTHLY WEATHER REVIEW for May, 1901, p. 216.—*H. H. K.*

### WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. H. W. Richardson, Local Forecast Official, Duluth, Minn., has arranged to deliver a course of lectures before the West Superior (Wisconsin) Normal School during the present school year.

The first of the series was given in the Weather Bureau office at Duluth before the class in physiography, and such subjects as instruments and observations, the weather elements, the general movements of highs and lows, and weather maps and weather forecasting were very briefly considered.

On September 24 the second lecture of the series was delivered at the Assembly Hall of the school before the faculty and students to the number of about 300, the subject being the United States Weather Bureau.

Mr. J. Warren Smith, Section Director, Columbus, Ohio, lectured upon "Weather" before the seventh grade teachers' association of that city on September 28. This lecture was to be followed by two others, on October 1 and 3, respectively, before this same association of teachers, who now have meteorology included among the subjects they are to teach.—*H H. K.*

### CORRIGENDA.

MONTHLY WEATHER REVIEW for July, 1901, p. 299, line 10, for "Ammerschweid" read "Ammerschweier." In the table on same page, line 1, under barometer (corrected) for "756.5" read "759.0." In the same column, opposite 9.05 a. m., insert "746.5."

Under "Remarks," opposite 11.23½ a. m., insert "We approach the cumulus turrets that rise from the cloud sea much higher than the balloon."

MONTHLY WEATHER REVIEW for July, 1901, p, 317, column 1, line 12, dele "Wis." Back cover, table of contents, column 2, line 11, dele "Wis."

MONTHLY WEATHER REVIEW for August, 1901, page 354, column 1, line 18, for "mentioning" read "maintaining."

## THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Professor of Meteorology.

### CHARACTERISTICS OF THE WEATHER FOR SEPTEMBER.

The rainfall of September was heavier than it has been in any September during the last ten years. In other respects the weather was not greatly different from the normal for the season. There were no destructive storms of a general nature and few severe local storms.

In the South Atlantic States, away from the coast, the rains were unusually heavy as in the preceding month, and in the middle Missouri and middle Mississippi there was a second area of heavy rains, culminating in eastern South Dakota with a fall of about four inches above the seasonal average. The rain on the middle and south Pacific coasts was also in excess of the seasonal average.

## PRESSURE.

The distribution of monthly mean pressure is graphically shown on Chart IV and the numerical values are given in Tables I and VI.

Mean pressure was below the normal generally west of the ninetieth meridian, except along the northern boundary and in the British Possessions. It was normal or slightly above in the Lake region and the Ohio Valley. In respect to departures from the normal, monthly mean pressure for September was practically the same as in the corresponding month of 1900. Mean pressure generally rises from August to September, the rise being greatest over the eastern part of the country. In the last ten years there have been but three Septembers during which mean pressure over the greater part of the country was lower in September than in August.

## TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

The month was abnormally cool in the northwest and generally throughout the Pacific coast and the Plateau region. Temperature was also below the average in the Gulf States and thence northeastward over the mountain regions of West Virginia, Virginia, North and South Carolina, and Georgia. Maximum temperatures of 100° were registered in southwestern Texas and at a few isolated places in the northern part of the State, also in western Arizona and southern California. A maximum temperature of 90° and over was not registered in the mountain districts east of the Mississippi, nor in the Lake region and New England. Freezing temperatures were recorded in the northern part of Michigan, in Minnesota, the Dakotas, and generally throughout the Rocky Mountain region.

The average temperature for the several geographic districts, and the departures from the normal values are shown in the following table:

*Average temperatures and departures from the normal.*

| Districts. | Number of stations. | Average temperatures for the current month. | Departures for the current month. | Accumulated departures since January 1. | Average departures since January 1. |
|---|---|---|---|---|---|
| | | ° | ° | ° | ° |
| New England | 10 | 62.4 | + 1.7 | + 0.8 | + 0.1 |
| Middle Atlantic | 12 | 68.2 | + 1.1 | + 1.3 | + 0.1 |
| South Atlantic | 10 | 74.6 | + 0.4 | − 9.7 | − 1.1 |
| Florida Peninsula | 7 | 79.4 | + 0.2 | −13.3 | − 1.5 |
| East Gulf | 7 | 75.7 | − 0.3 | − 8.3 | − 0.9 |
| West Gulf | 7 | 76.0 | − 0.1 | + 6.7 | + 0.7 |
| Ohio Valley and Tennessee | 12 | 68.4 | − 0.3 | − 3.5 | − 0.4 |
| Lower Lake | 8 | 64.2 | + 1.0 | + 2.0 | + 0.2 |
| Upper Lake | 9 | 59.8 | + 0.8 | +10.9 | + 1.2 |
| North Dakota | 8 | 54.0 | − 2.6 | +23.3 | + 2.6 |
| Upper Mississippi Valley | 11 | 65.4 | + 0.5 | +16.0 | + 1.8 |
| Missouri Valley | 10 | 64.5 | − 0.7 | +26.4 | + 2.9 |
| Northern Slope | 7 | 55.1 | − 3.0 | +16.4 | + 1.8 |
| Middle Slope | 6 | 68.0 | + 0.2 | +13.8 | + 1.5 |
| Southern Slope | 6 | 72.9 | + 0.9 | + 7.8 | + 0.9 |
| Southern Plateau | 15 | 67.8 | − 1.2 | + 2.3 | + 0.3 |
| Middle Plateau | 9 | 57.7 | − 2.6 | + 8.5 | + 0.9 |
| Northern Plateau | 10 | 54.9 | − 3.0 | + 8.8 | + 1.0 |
| North Pacific | 9 | 56.1 | − 1.3 | − 8.2 | − 1.0 |
| Middle Pacific | 5 | 61.5 | − 1.7 | − 4.6 | − 0.5 |
| South Pacific | 4 | 65.7 | − 2.6 | + 1.3 | + 0.1 |

In Canada Prof. R. F. Stupart says:

The temperature was below the average from the mainland of British Columbia as far as, and including the Lake Superior district, and above the average elsewhere in Canada except in the extreme northeastern portion of the Province of Quebec where the average was just maintained. Over the greater part of the Northwest Territories the deficiency was from 6° to 7° degrees, while in the Maritime Provinces the excess was from 3° to 4°, and in Ontario from 1° to 3°.

## PRECIPITATION.

The rainfall was 75 per cent or more of the normal in all but two of the geographic districts into which the country has been divided. The rainfall in the Missouri Valley was unusually heavy, being almost double the normal for the season. The rainfall was also very heavy in the western Gulf States with 145 per cent of the normal, North Dakota, 148 per cent, northern slope, 175 per cent, and the northern Plateau, 177 per cent. Heavy rains for the season also fell on the middle and south Pacific coasts.

*Average precipitation and departure from the normal.*

| Districts. | Number of stations. | Average. | | Departure. | |
|---|---|---|---|---|---|
| | | Current month. | Percentage of normal. | Current month. | Accumulated since Jan. 1. |
| | | *Inches.* | | *Inches.* | *Inches.* |
| New England | 10 | 3.06 | 97 | −0.1 | + 0.4 |
| Middle Atlantic | 12 | 3.20 | 84 | −0.6 | − 0.8 |
| South Atlantic | 10 | 5.38 | 100 | 0.0 | + 1.7 |
| Florida Peninsula | 7 | 7.44 | 100 | 0.0 | + 5.8 |
| East Gulf | 7 | 3.38 | 79 | −0.9 | + 0.1 |
| West Gulf | 7 | 5.76 | 145 | +1.8 | − 3.2 |
| Ohio Valley and Tennessee | 12 | 2.84 | 97 | −0.1 | − 7.1 |
| Lower Lake | 8 | 2.92 | 100 | 0.0 | − 1.0 |
| Upper Lake | 9 | 2.86 | 83 | −0.6 | − 4.8 |
| North Dakota | 8 | 2.16 | 148 | +0.7 | + 1.2 |
| Upper Mississippi Valley | 11 | 3.22 | 100 | 0.0 | − 7.8 |
| Missouri Valley | 10 | 4.66 | 197 | +2.3 | − 4.7 |
| Northern Slope | 7 | 1.68 | 175 | +0.7 | + 1.6 |
| Middle Slope | 6 | 1.58 | 89 | −0.2 | − 5.5 |
| Southern Slope | 6 | 1.83 | 75 | −0.6 | − 3.5 |
| Southern Plateau | 15 | 0.40 | 50 | −0.4 | + 0.9 |
| Middle Plateau | 9 | 0.22 | 32 | −0.5 | + 0.3 |
| Northern Plateau | 10 | 1.84 | 177 | +0.8 | − 1.1 |
| North Pacific | 9 | 3.00 | 97 | −0.1 | − 0.1 |
| Middle Pacific | 5 | 1.91 | 269 | +1.2 | + 0.4 |
| South Pacific | 4 | 0.20 | 200 | +0.1 | + 2.0 |

Snow fell in the mountain districts of California and quite generally in the Rocky Mountain region from Colorado northwestward as far as the field of observation extended.

### HAIL.

The following are the dates on which hail fell in the respective States:

Arkansas, 11. California, 22, 23, 24. Colorado, 2, 3, 6, 7, 9, 13, 20, 29, 30. Georgia, 10. Idaho, 3, 22, 23. Indiana, 18. Iowa, 25, 38. Kansas, 10, 13. Maryland, 1, 15. Massachusetts, 11. Michigan, 12, 17, 18. Minnesota, 15, 16, 24, 27, 28, 30. Missouri, 9, 10, 13. Montana, 4, 14, 15, 20, 26, 28. Nebraska, 6, 8, 11, 24, 26. Nevada, 2, 3, 22, 23. New Jersey, 12, 15. New Mexico, 1, 2, 8, 9, 10, 27, 29, 30. New York, 11, 15, 28. North Dakota, 13, 14, 24, 30. Ohio, 18. Oregon, 25, 26. Pennsylvania, 1, 11. South Dakota, 6, 13, 15, 24, 25, 28, 30. Tennessee, 16, 17. Texas, 14. Utah, 3. Virginia, 10. Washington, 26. West Virginia, 9. Wisconsin, 15, 18, 27. Wyoming, 3, 6, 10, 24.

### SLEET.

The following are the dates on which sleet fell in the respective States:

California, 23. Idaho, 22. Michigan, 18. Minnesota, 16, 17. Montana, 6, 7. North Dakota, 29. Ohio, 18. South Dakota, 11, 15. Utah, 24. Wyoming, 24.

In Canada Professor Stupart says:

The precipitation was much above the average in the Northwest Territories and Manitoba; average or a little above over the larger portion of British Columbia; above the average along the south shore of Nova Scotia and below in all the remaining portions of Canada, except at a few places in Ontario where it was also above the average. In the Territories and Manitoba the excess was from one and a half to three inches, and snow was generally recorded on more than one occasion. In Quebec the deficiency was an inch and over in nearly all portions of the Province, and in Ontario it was for the most part from a tenth to half an inch, except at Peterboro and Welland where it reached 1.70 and 2.10 inches, respectively. The chief excesses reported in Ontario were Ridgetown 1.32 inches, Stony Creek 0.9 of an inch, Brantford and Orilla 0.8 of an inch. Halifax recorded as much as three inches and a quarter above the average, while Chatham, N. B., was an inch below the average.

## HUMIDITY.

The averages by districts appear in the subjoined table:

*Average relative humidity and departures from the normal.*

| Districts. | Average. | Departure from the normal. | Districts. | Average. | Departure from the normal. |
|---|---|---|---|---|---|
| | % | | | % | |
| New England | 82 | 0 | Missouri Valley | 68 | +1 |
| Middle Atlantic | 79 | +2 | Northern Slope | 68 | +15 |
| South Atlantic | 81 | 0 | Middle Slope | 62 | +4 |
| Florida Peninsula | 83 | +1 | Southern Slope | 65 | +3 |
| East Gulf | 77 | 0 | Southern Plateau | 37 | −5 |
| West Gulf | 73 | −1 | Middle Plateau | 34 | −3 |
| Ohio Valley and Tennessee | 76 | +3 | Northern Plateau | 58 | +6 |
| Lower Lake | 74 | 0 | North Pacific Coast | 76 | −5 |
| Upper Lake | 78 | +2 | Middle Pacific Coast | 64 | −4 |
| North Dakota | 76 | +11 | South Pacific Coast | 68 | +3 |
| Upper Mississippi | 70 | −2 | | | |

## SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

*Average cloudiness and departures from the normal.*

| Districts. | Average. | Departure from the normal. | Districts. | Average. | Departure from the normal. |
|---|---|---|---|---|---|
| New England | 4.5 | −0.5 | Missouri Valley | 4.5 | +0.5 |
| Middle Atlantic | 4.7 | −0.1 | Northern Slope | 5.2 | +1.2 |
| South Atlantic | 4.7 | −0.1 | Middle Slope | 4.0 | +0.8 |
| Florida Peninsula | 5.9 | +0.4 | Southern Slope | 4.4 | +0.8 |
| East Gulf | 4.5 | +0.1 | Southern Plateau | 1.3 | −1.0 |
| West Gulf | 4.2 | −0.1 | Middle Plateau | 1.6 | −0.9 |
| Ohio Valley and Tennessee | 4.0 | −0.4 | Northern Plateau | 5.1 | +1.0 |
| Lower Lake | 4.6 | −0.2 | North Pacific Coast | 5.0 | +0.1 |
| Upper Lake | 5.6 | +0.5 | Middle Pacific Coast | 3.6 | +0.8 |
| North Dakota | 5.9 | +1.6 | South Pacific Coast | 2.5 | 0.0 |
| Upper Mississippi | 4.4 | +0.2 | | | |

## WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

*Maximum wind velocities.*

| Stations. | Date. | Velocity. | Direction. | Stations. | Date. | Velocity. | Direction. |
|---|---|---|---|---|---|---|---|
| Buffalo, N. Y. | 16 | 53 | sw. | Mount Tamalpais, Cal. | 29 | 69 | nw. |
| Cape Henry, Va | 18 | 56 | ne. | Point Reyes Light, Cal. | 1 | 52 | nw. |
| Do | 19 | 50 | ne. | Pueblo, Colo | 19 | 50 | n. |
| Denver, Colo | 24 | 50 | nw. | San Juan, Porto Rico | 12 | 52 | se. |
| Modena, Utah | 23 | 60 | sw. | Santiago de Cuba | 13 | 54 | se. |
| Mount Tamalpais, Cal. | 12 | 55 | nw. | Sioux City, Iowa | 11 | 50 | se. |
| Do | 23 | 53 | sw. | | | | |

## ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—Reports of 2,629 thunderstorms were received during the current month as against 2,563 in 1900 and 5,891 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 11th, 255; 10th, 210; 15th, 198.

Reports were most numerous from: Nebraska, 234; Missouri, 163; Kansas, 156.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 24th to October 2d.

*In Canada:* Thunderstorms were reported as follows: Halifax, 13; Grand Manan, 16; Yarmouth, 5, 13; Charlottetown, 14; Quebec, 7, 16; Montreal, 7, 16; Toronto, 10, 12; White River, 28; Port Stanley, 12; Parry Sound, 16, 23; Port Arthur, 27, 28; Winnipeg, 24; Minnedosa, 4, 5, 25; Qu'Appelle, 4, 9, 24; Medicine Hat, 12, 13; Swift Current, 1; Banff, 1; Battleford, 10; Hamilton, Bermuda, 11, 15.

*Auroras.*—Auroras were reported as follows; Grand Manan, 10; Quebec, 10; Port Arthur, 11; Winnipeg, 11; Qu'Appelle, 10; Swift Current, 10; Battleford, 11, 12.

# DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Professor of Meteorology.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.